GLASS SUBSTRATE TRANSPORT BOX

FIELD OF THE INVENTION

This invention relates to a glass substrate transport box for use in the transport of glass substrates inclusive of glass blanks, liquid crystal display panel glass substrates, plasma display panel glass substrates, fluorescent display tube glass substrates, thermal head glass substrates, color filter or other glass substrates, and panels fabricated using such glass substrates.

BACKGROUND OF THE INVENTION

For the transport of glass substrates (inclusive of finished panels) from and to the glass manufacturer, color filter manufacturer and device manufacturer, glass substrate transport boxes manufactured by the injection-molding of various resins, such as ABS resin and polyvinyl chloride resin, or the assembling of members molded from such resins are in use. For the transport of glass substrates equipped with printed circuits, such as glass substrates carrying thin-film transistors (TFT), or complete liquid crystal cell panels, injection-molded or assembled boxes manufactured using a resin composition containing an electrically conductive polymer or an antistatic agent are employed.

The typical glass substrate transport box comprises a bottomed body and a lid, with the two opposed side walls of the body being formed with grooves for supporting glass substrates in a parallel array with a clearance provided between adjacent grooves for isolation of the substrates from one another in a vertical or horizontal position.

The typical glass substrate transport box accepts ten and odds to tens of glass substrates. The box is sometimes provided with a purging port for replacing the internal atmosphere with an inert gas such as N_2.

While the injection-molded or assembled resin box heretofore used for the transport of glass substrates is capable of keeping glass substrates gas-tight, even the dead weight of the box itself is so great, for example 5–6 kg, that it cannot be easily handled in relocating, stacking or shipment.

Furthermore, the resin box manufactured by injection molding is lacking in cushioning characteristics and, therefore, virtually cannot absorb the shock and impact on dropping so that the glass substrates accommodated therein may break or the box itself may be damaged.

Furthermore, since the injection-molded resin box has a high heat conductivity of, for example, 0.26 Kcal/m.hr.°C., TFT-mounted glass substrates or finished panels may experience temperature buildups due to the poor heat insulation of the box during transport and the consequent dew condensation stains the glass substrates or impairs the circuits, thus detracting from the reliability of the products.

In addition, the combined manufacturing cost of the injection molds required for the molding of the body and lid of the box may amount to, for example, 15 million~20 million yen and the amount of resin required may be as large as, for example, 5–6 kg per box. Therefore, the total cost of the injection molds and resin material amounts to a considerable sum.

OBJECT AND SUMMARY OF THE INVENTION

Under the circumstances, this invention has for its object to provide a glass substrate transport box which is easy to handle, improved in transportability and in the protection of glass substrates, and which can be manufactured at a markedly reduced cost compared with any of the conventional boxes.

The glass substrate transport box of this invention is characterized in that at least the body of the box is made of a resin foam, preferably a polyolefin foam, blown to a foaming ratio of 3–30, and that a pair of opposed inner sides of said body are formed with grooves for supporting glass substrates.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view showing one example of the glass substrate transport box according to this invention, with its lid being shown partially exploded; and

FIG. **2** is a partially exploded front view showing another example of the glass substrate transport box according to this invention.

DETAILED DESCRIPTION OF THE INVENTION

Of the glass substrate transport box according to this invention, at least a body **1** is made of a resin foam blown to a foaming ratio of 3–30.

While a variety of resin foams can be used for the manufacture of said body **1**, olefinic resin foams are most suited for the purpose. The olefinic resin foam includes ethylene series polymer foams such as low density polyethylene foam, high density polyethylene foam, ethylene-vinyl acetate copolymer foam, ionomer foams and olefinic polymer blend foams, polypropylene foam and so on.

The foaming ratio of such resin foam should be 3–30 or preferably 4–25. If the foaming ratio is less than 3, the objectives of weight reduction, protection (cushioning) of glass substrates, and thermal insulation cannot be sufficiently accomplished, while a foaming ratio over 30 results in insufficient mechanical strength and excessive resiliency.

A typical preferred process for producing such a resin foam comprises filling a metal mold with polyolefin beads containing a blowing agent or a primary foam obtained from such beads and heating the mold at a predetermined temperature. The blowing agent may be an evaporation type blowing agent or a chemical decomposition type blowing agent. If necessary, two or more different blowing agents can be used in combination. Since the bead foaming process is a low-pressure process, a low-cost mold made of, for example, aluminum can be employed. Of course, in lieu of the bead foaming process, other foaming processes can likewise be employed.

The box of this invention comprises either a bottomed body **1** and a lid **2** or an open-bottom body **1**, a lid **2** and a bottom member **3**. Preferably the lid **2** and bottom member **3** are also made of resin form. From strength points of view, the thickness of the respective members of the box is preferably about 15–100 mm.

A pair of opposed inner side walls of the body **1** is formed with grooves **4** for supporting glass substrates in the foaming process. The other pair of opposed inner sides of the body **1** is usually not provided with such grooves but may be formed with grooves for accommodating glass substrates of other dimensions. The lid **2** and bottom member **3** need not be provided with grooves but, if required, may also be formed with grooves.

The grooves **4** mentioned above should be of sufficient depth and width to accept the edges of glass substrates with some clearance allowing a small play of the glass substrates.